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Mini open surgical treatment of knee septic arthritis with local anesthesia: a prospective preliminary report

Surgical treatment of knee septic arthritis with local anesthesia

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Abstract

Aim: Good pain management is provided via spinal and general anesthesia during knee joint drainage to treat septic arthritis, but the side effects are greater than those associated with local anesthesia, and the preparation process is long. Arthroscopic drainage under local anesthesia for knee septic arthritis treatment have been described, but this method requires special equipment. In this study, we aimed to evaluate the applicability of mini-open surgery under local anesthetic infiltration in cases of septic knee arthritis. Material and Method: 14 consecutive patients (eight men, six women) were admitted for knee septic arthritis treatment. Patient age ranged from 18 to 56 years, with an average age of 33 years. Drainage procedure was performed under local anesthesia, and the results were evaluated clinically. Results: The visual analog scale scores were between two and four (mean 2.8). The follow-up period was 10-21 months (mean 14.3). The Tegner and International Knee Documentation Committee scores were acceptable except for one patient. Discussion: This prospective study included mini-open surgery performed under local anesthesia on 14 septic knees, and showed that this method is safe, effective, well tolerated and be alternative to conventional techniques.

Keywords

Knee Joint; Septic Arthritis; Local Anesthesia; Mini-Open Surgery

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Introduction

Surgical drainage is the most effective treatment for septic arthritis [1]. Knee septic arthritis drainage is performed with local, regional and general anesthesia. The use of local anesthesia rather than general or spinal anesthesia has several advantages. For example, there is no need for an anesthetist, it simplifies postsurgical patient management [2], and it eliminates the need to fasting for at least a few hours [3,4]. This last point is important because any delay in administering treatment for septic arthritis can affect prognosis [5]. In addition, regional and general anesthesia has more complications than the local anesthesia.

Local anesthesia for arthroscopic knee intervention is a well-documented treatment, but this method requires specialized arthroscopic equipment [6-9]. In addition, insufficient sterilization of contaminating equipment can lead to infection during subsequent operations [10].

There is no literature in English regarding drainage of the septic arthritis of the knee using the mini-open technique. In this study, we aimed to evaluate the applicability of mini-open surgery under local anesthetic infiltration in cases of septic knee arthritis. The present study aimed to report the results of a prospective study of 14 consecutive mini open-surgeries to drain septic knees conducted under local anesthesia.

Material and Method

The study was approved by our university's ethical committee, and all patients gave their informed consent prior to their inclusion in the study. Fourteen consecutive and compatible patients (eight men, six women) age ranged from 18 to 66 years were admitted for septic knee arthritis treatment. Inclusion criteria were patients who had the complaint fewer than for five days. Exclusion criteria were the allergy to local anesthetic agents or non-steroidal anti-inflammatory drugs, in cases where local anesthesia can not be tolerated, and presence of metaphyseal osteomyelitis. Patients younger than 18 years were also excluded. Diagnosis of septic arthritis was made with clinical examination, and laboratory tests, including leukocyte number, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP) values, joint ultrasonography, and magnetic resonance imaging in some patients but mainly as a result of the evaluation of the sample obtained by joint aspiration. Direct examination of the sample under a microscope, the presence of bacteria or the determination of polymorphonuclear leukocytes more than 90% was regarded as sufficient for the diagnosis [11-12].

After the intraoperative sample was collected, empirical therapy was initiated as intravenous cefazolin, and it was changed as needed according to the culture results. Antibiotic therapy was given parenterally to all patients for 4 weeks, then orally for 2 weeks. Treatment effectiveness was clinically evaluated by assessing reductions in local pain, temperature, effusion and redness of the knee. Leukocyte, ESR, and CRP values were also measured. When improvement was detected in clinical and laboratory findings, the patients were instructed to begin active and passive motion intervals of the knee joint and were mobilized with crutches.

Surgical preparation and application

The same surgeon (MFC) marked an approximately 2-3 cm incision line on the skin with an indelible pen (Figure 1). A mixture of 2% prilocaine (10 mL) and 0.5% bupivacaine (10 mL) in a 1:1 ratio was used for local anesthesia, and then, an intravenous cannula was inserted to administer 0.25 mL/kg. Next, the surgeon infiltrated anesthetic agent from the skin to the synovium at previously marked sites at least five minutes before operation. The patient was observed to pulse and blood pressure. After infiltration of local anesthesia, efficacy was assessed with hot-cold and pinprick susceptibility tests. A tourniquet was not used for all patients.

Figure 1. Intraoperative view of the lateral parapatellar incision.

An anterolateral parapatellar incision was used on all of the patients, and then, the surgeon performed a mini capsular incision to enter the joint. The purulent fluid was drained after a sample was taken. The joint was then washed with 6-8 L of saline. Visible articular cartilage was evaluated (Figure 2) before the aspirative drain was placed in the joint, and the tissues were properly sutured. The aspirative drain was kept in place for at least 48 hours after surgery and was removed when the drainage fell below 30 mL/day.

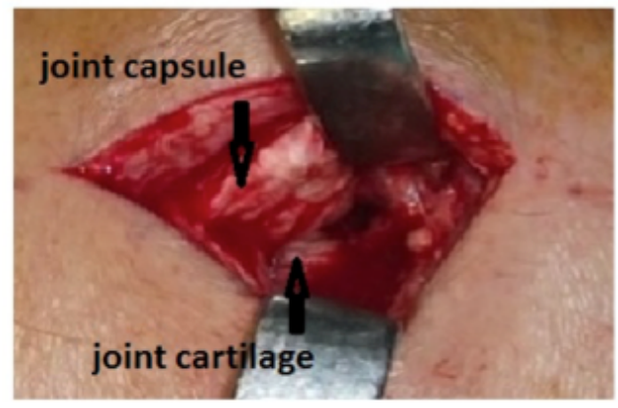

Figure 2. Joint evaluation. The joint capsule and condylar cartilage are marked with an arrow.

Clinical evaluation

We recorded following information about the patients: ages, gender, fasting periods at admission, accompanying systemic diseases, antibiotic use, how many days they had complaints during the application, gram staining and culture results, possible disease etiology and recurrence rates.

The acceptability of the technique and the quality of intra-operative local anesthesia were assessed using a 10-cm visual analog scale (VAS), with zero and ten labeled as 'no pain' and the 'worst pain' imaginable, respectively. The pain that the patient felt while the surgical procedures were performed was questioned on the first postoperative day. VAS pain score was not reassessed in patients who underwent subsequent treatment for recurrence. The treatment outcome was determined before surgery and at the final follow up using the Tegner Activity Level (TAL) scale and the International Knee Documentation Committee (IKDC) grading system[13,14].

Statistical method

Descriptive statistics were presented as the means±standard deviation, minimum and maximum values for the continuous variables (characteristics) while frequency and percent for categorical variables. Likelihood Ratio Chi-Square test was also performed to determine relationships between categorical variables. Statistical significance levels were considered as 5%, and SPSS 13 statistical program was used for all statistical computations.

Results

Data on the 14 patients who developed septic arthritis are listed in Table 1.

Three patients had controlled type 1 diabetes, and one had undergone hemodialysis for five years due to chronic renal failure. When the patients were diagnosed with septic arthritis, the fasting period was longer than six hours in just three patients (21%).

The mean number of leukocytes at diagnosis was 12.2x103±1.4x103/μL (between 11x103 and 16x103/μL, the normal value is 4x103 to 10x103/μL). The mean ESR was 64±31.6 mm/h (between 20 and 116 mm/h, normal value <20 mm/h), and the mean CRP level was 82±30.1 mg/L (between 53 and 177 mg/L, normal value <5 mg/L).

None of our patients developed complications due to the local anesthesia. The average VAS value was 2.8 (between 2 and 4). The postoperative period was managed with intravenous paracetamol, and there was no need for narcotic analgesics in any patients.

Re-washing was performed under local anesthesia for three of the patients (21%) within the first week after the surgery due to a lack of improvement in clinical and laboratory parameters. None of these patients showed evidence of pathogenic microorganisms in the first culture isolate. Notably, one was diabetics, and one was a hemodialysis patient. Three months after intervention, ESR and CRP values were within normal ranges in all patients.

Just one patient experienced pain and knee movement limitation; this was the hemodialysis patient who underwent a second procedure. Although X-ray did not reveal any degeneration, his knee flexion was limited up to 20 degrees, and he felt pain during flexion over 100 degrees. IKDC and TAL values determined in the last follow-up were significantly found better than before surgery ($P<0.05$). Table 2 shows subjective TAL and IKDC grades for all patients.

Table 2. Number of patients according to subjective IKDC grade and TAL before surgery and at the final follow-up

	IKDC grade				TAL		
	A	B	C	D	0-3	4-6	7-10
Preop	0	1	5	8	9	5	0
Follow	13	1	0	0	0	1	13

A: normal knee, B: nearly normal knee, C: slightly abnormal knee, D: abnormal knee
(Low activity level: 0–3, moderate activity level: 4–6, high activity level: 7–10)

Table 1. Data on the 14 patients who developed septic arthritis

Case No	Age	Sex	Side	Preop Drug	T1	Gram	Culture	T2	T3	Etiology	ASA
1	40	F	L	AAS	28	Gr+	-	15	3	Hematogen	1
2	50	F	R	-	30	Gr+	Stap Epi	13	4	Hematogen	2
3	31	M	R	-	27	Gr+	Stap Au	11	2	Hematogen	2
4	28	M	R	-	27	-	-	13	4	Trauma	1
5	18	M	R	AAS	30	-	-	10	3	Trauma	1
6	64	F	L	-	28	-	-	21	4	Injection	3
7	66	M	R	FQ	30	-	-	16	3	Injection	4
8	39	F	R	-	29	Gr+	Stap Epi	12	4	Trauma	2
9	59	M	L	CA	28	-	-	11	3	Injection	3
10	33	F	R	AAS	29	-	-	20	1	Injection	1
11	54	M	L	-	30	-	-	12	2	Hematogen	3
12	18	F	R	CA	26	-	-	19	3	Hematogen	1
13	26	M	L	AAS	27	-	-	17	3	Hematogen	1
14	38	M	L	-	30	Gr+	Strepto	10	2	Hematogen	2
Mean±SD	40±16	M-8 F-6	R-8 L-6	50%	28.5±1.4	35.7%	28.6%	14.3±3.75	2.9 ±0.92		1.9±1

AAS: Ampicillin and sulbactam, CA: Cefuroxime axetil, FQ: Fluoroquinolones F: Female, M: Male, T1: Operation time-minute, T2: Follow time-month, T3: Complain time-day, Stap Epi: Staphylococcus epidermitis, Strepto: Streptococcus pyogenes, Stap Au: Staphylococcus aureus, ASA: American Society of Anesthesiologists

Discussion

The knee joint is the most common site of septic arthritis [15]. Joint contamination is usually the result of hematogenous bacterial infection, and similarly, it can also occur following surgery, joint injection or trauma [16-18]. Half of the patients who were included in this study had hematogenous septic arthritis.

The septic arthritis of the knee joint is diagnosed with the help of clinical, laboratory, and radiological evidence [1]. The most common symptoms are systemic high fever, pain, effusion, skin redness, movement limitation and increased temperature of the joint. Elevated acute phase reactants, determination of bacteria in the gram stain of the sample taken from the joint, or increased levels of polymorphonuclear leukocytes may help the diagnosis. The culture of the sample obtained from the joint fluid by puncture is necessary to identify the pathogen in the diagnosis of septic arthritis and to determine which antibiotics to administer [1,19]. The absence of bacterial proliferation in the sample obtained from the joint fluid does not exclude a diagnosis of septic arthritis. In patients with negative gram stain results, the detection of bacteria or more than 90% polymorphonuclear leukocytes was sufficient for diagnosis [11]. The present literature reports low rates of 18-48% for culture-negative septic arthritis [20]. Reproduction in culture was detected in four of our cases (28.6%), and this low rate was associated with broad-spectrum antibiotic use before applying for emergency department in half of the patients.

It has been suggested that the most important prognostic factor for septic arthritis was the time elapsed between symptom onset and surgical treatment. Complications that develop as a result of septic arthritis are serious conditions, such as cartilage damage, osteomyelitis, avascular necrosis, septic dislocation and sepsis [11]. According to the literature, cases are considered to have delayed treatment if symptoms have manifested for more than four days [5]. It has been emphasized that joint damage can be prevented with proper surgical drainage and antibiotic treatment following timely diagnosis of acute septic arthritis [21]. In our series, the average time from the start of complaints to surgical intervention was less than four days (2.9), and we achieved good outcomes.

A fasting period is necessary for general or regional anesthesia. If emergency surgical drainage is performed for patients who do not have a sufficient fasting period, serious complications may develop due to aspiration of gastric content [3,4]. Accordingly, surgical treatment of the patients under regional or general anesthesia may be delayed due to an insufficient fasting period. In this study, only 21% of the patients had a fasting period of more than six hours. This method, which can be applied with local anesthesia, is the most important advantage over other methods in that it does not require fasting time.

Joint drainage and washing are the basic surgical procedures in the treatment of septic knee arthritis. These processes can be performed arthroscopically, open surgery, and needle aspiration. The final method is conservative, and its effectiveness is lower than both types of surgical procedures [22]. During intervention, general, regional or local anesthesia may be preferred by the patient. While these methods are comparable to each other, treatment efficacy, patient pain tolerance, and anesthesia complications are taken into consideration when making a selection [6]. Local anesthesia was found effective because pain tolerance is good, the joint can be washed adequately and the anesthesia risk is low.

Spinal and general anesthesia during intervention to treat knee disorders provides better pain control, but the side effects are more serious than local anesthesia, and it has a long preparation process. In addition, local anesthesia cost is low, and the patient remains awake in this method [6,23,24]. However, it cannot be used in children and incompatible adult patients. If the patient's ASA score increases complications also increase in the surgery [25]. Intervention with local anesthesia is more advantageous for patients with a high ASA score. In this study, the score of four patients was higher than 2, and no complication was encountered.

Septic arthritis surgery performed under local anesthesia; while it is a safe method, it is necessary to be careful regarding possible side effects, such as cardiac toxicity, methemoglobinemia and allergic reactions [26-28]. The total local anesthetic amounts given to the patients in our study did not exceed the recommended [29] maximum safe dose of 2 mg/kg for bupivacaine and 7 mg/kg for prilocaine, and no side effects were observed.

Many studies have previously reported successful results regarding the surgical treatment of septic knee arthritis arthroscopically [30-32]. However, under local anesthesia, there are few studies in which this procedure is applied [33]. There are advantages of this method, such as a lack of adverse effects associated with regional and general anesthesia, performing debridement while visualizing the joint, economic benefits and less tissue damage compared to open surgery [23,33]. But this method is not suitable for the presence of associated metaphyseal osteomyelitis. However, this method requires special arthroscopy equipment.

Iatrogenic infection resulting from arthroscopy is an increasingly frequent source of septic arthritis. In general, the risk of procedure-related septic arthritis has been estimated at 0.15-4.2% for arthroscopies [34-36]. In 70 ligament reconstruction surgeries performed by Viola et al., infection was detected in 10 patients, and they found that the origin of contamination (*coagulase-negative Staphylococcus*) was the supposedly sterile inflow cannula. When they changed this device, they had only one infection in the next 400 reconstructions [10]. Similarly, Blevins et al. found that the cannulas used after the arthroscopic meniscus repair caused infection in three patients [37]. Parada et al. detected the instrumentation-specific infection after the anterior cruciate ligament reconstruction [38]. It has been reported that septic arthritis following knee arthroscopy could result in malpractice litigation [39]. For these reasons, maximum attention should be paid to sterilization so that arthroscopic devices used in the surgery of septic arthritis do not cause septic arthritis in subsequent patients. We could not find any information in the literature regarding sterilization of arthroscopy equipment used in the surgical treatment of septic arthritis.

The lack of control group, the small number of patients and the short follow-up time can be considered as limitations of our study. A larger prospective, randomized study with, long-term follow-up is needed to more accurately assess the effectiveness of this method. The inside of joint cannot be evaluated in detail

using this method. For this reason, the method should not be employed in those with chronic infection or in patients who will undergo synovectomy. In addition, an open intervention would be more appropriate under regional or general anesthesia in the presence of concomitant metaphyseal osteomyelitis.

In conclusion, the anesthetic doses described here are appropriate for local anesthesia and are safe in terms of complications. Mini-open surgery under local anesthesia appears to be a good option when the patient has high risk for general anesthesia. We conclude that this method can safely and effectively be performed under local anesthesia without the need for arthroscopy equipment and fasting period.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

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